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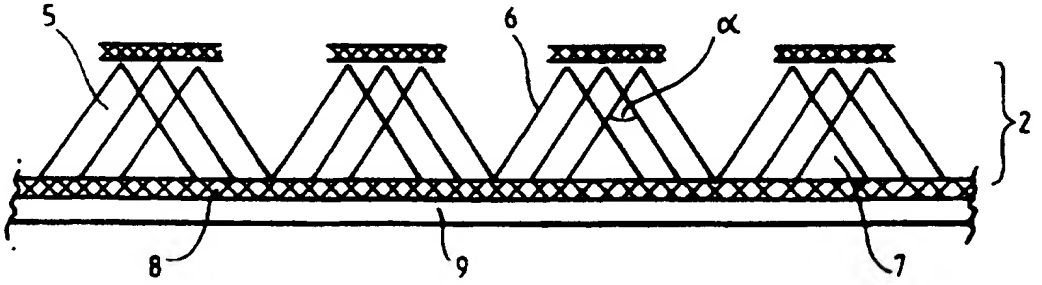

(57) Abstract

A spacer material suitable for use, for example, as a mattress cover material, which comprises a fabric, providing a liquid permeable and breathable upper surface (3) and a heat and liquid dissipating spacer layer (2), and a liquid impermeable lower surface layer (8).

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IMPROVEMENTS IN OR RELATING TO SPACER MATERIALS

This invention relates to spacer materials and more particularly to a novel spacer material and a novel mattress cover and composite mattress construction produced therefrom.

For the past twenty years the most common form of cot mattress provided for babies and young children has been the ventilated mattress. A typical ventilated mattress construction comprises a core, consisting of a resilient layer of foamed plastics material having relatively large holes or perforations therethrough, covered by a fabric layer. The relatively large holes in the foam core have been considered necessary because of the hitherto recommended practice of laying babies on their stomachs on the cot mattress and the concern that the baby must be able to breathe comfortably when in this position.

Ventilated cot mattresses are not easy to wash, and as a result vomit and other bodily excretions tend to become trapped in the perforations or holes in the foamed plastics core. These mattresses are therefore rather insanitary, and are capable of spreading diseases.

Whilst the practice of laying a baby on its stomach on the cot mattress is now disapproved of, it is still

believed to be essential to provide the foam core mattress with a perforated body or core for allowing the baby to breathe comfortably if it should accidentally turn over and lie face down. However such mattresses are heat insulators and are unable to conduct heat away from the baby to prevent the risk of heat stress occurring.

Recent publicity has blamed certain additives containing antimony, phosphorus and arsenic which are used as fire retardants in polymeric materials for a number of cot deaths. These fire retardants are therefore no longer accepted for use in either the interior core or the fabric outer layers of cot mattresses.

For all the above reasons there has been a return to the use of traditional sprung mattresses as cot mattresses, but these are far more expensive, and still very difficult to keep clean.

A spacer fabric comprises a warp knitted double face construction in which the fabric faces are interconnected by a spacer yarn. Spacer fabrics have been suggested for many applications, and, for example, typical spacer fabrics and their potential uses are disclosed in DE3004444, DE4239068, DE-U-9016062.2, DE-U-9309374.8 and DE3139402, the entire disclosures of which are incorporated herein by reference.

In the brochure "Spacer Fabrics - Manufacturing Methods and Applications" published in 1994 by Karl Mayer Textilmaschinenfabrik GmbH, a spacer fabric for a mattress cover is disclosed, the fabric having one dense and one open structure surface and a height of 4 to 12mm. There is no suggestion, in the context of cot mattresses, that the spacer fabric disclosed is to be used with anything other than a traditional sprung mattress, or a ventilated foam mattress body or core. The spacer fabric proposed is still a knitted, permeable structure and would not completely prevent body fluids from penetrating into the core or body of the mattress. Furthermore, the brochure does not address the problems of baby breathability, heat dissipation and fire retardance previously discussed in connection with cot mattresses. The entire disclosure of the brochure is incorporated herein by reference for all purposes.

The present invention provides a novel spacer material which substantially obviates at least some of the problems set out above, and which comprises in combination a permeable heat and liquid dissipating fabric and a liquid impermeable layer.

According to the present invention, a novel spacer material comprises a fabric providing a liquid permeable and breathable upper surface and a heat and liquid

dissipating spacer layer, and a liquid impermeable lower surface layer.

In a further aspect, the invention provides a mattress cover material which comprises a spacer material comprising a fabric providing a liquid permeable and breathable upper surface and a heat and liquid dissipating spacer layer, and a liquid impermeable lower surface layer.

In another aspect the invention provides a cot mattress comprising a foam plastics core and a cover comprising a spacer material comprising a fabric providing a liquid permeable and breathable upper surface and a heat and liquid dissipating spacer layer, and a liquid impermeable lower surface layer.

In preferred embodiments of the invention the mattress achieves a pass under BS Standard 7177 for resistance to ignition of mattresses, divans and bed bases and BS Standard 1877 fire retardancy test for mattresses and bumpers for childrens' cots, perambulators and similar domestic articles and is devoid of fire retardant additives comprising antimony, phosphorus or arsenic.

Preferably the fabric is a spacer fabric, which may have an upper surface in the form of a warp knitted mesh.

The mesh hole size is preferably as large as possible for drainage and ventilation purposes, but should not be so large as to cause discomfort when placed next to the skin. A mesh average hole diameter of from 1 to 3mm, preferably around 2mm, has been found to give particularly good results.

The upper surface of the spacer fabric is preferably such that liquids and air can easily pass therethrough and into the spacer layer and the spacer fabric is preferably such that it has an enhanced ability to conduct liquid away from the surface and dissipate it through the fabric structure, and such that it permits passage of air through the structure.

Preferably the upper surface of the spacer fabric is such that liquids of viscosity of at least 20 dynes/cm and more preferably of at least 30 dynes/cm can pass through the upper surface and into the spacer layer without lying on the surface. Preferably the upper surface of the spacer fabric has a grade of less than 1 when tested in accordance with the Oil Repellency Rating AATCC method.

The spacer fabric preferably also has a high wickability, which is defined as the ability of the fabric to conduct liquid away from the area of initial contact and form a relatively thin liquid film within the

fabric structure. Wickability can be measured in accordance with BS 3424 Part 18 by suspending test specimens vertically over a tray of water containing a suitable dye and measuring the height to which the liquid rises in a given time. Preferably the spacer fabric is such that the wicked liquid rises to a height of at least 100mm, and more preferably at least 125mm, when tested in both the warp and weft directions, in a time of 40 minutes.

A further measure of the ability of the spacer fabric to take liquid away from its surface and dissipate it through the fabric structure is a water dispersion test in which a solution containing a suitable dye is used to measure the spread of liquid into and through the fabric. In this test, a measured amount of liquid (0.5ml) is applied to the fabric upper surface. The dimensions of the area stained due to the spread of liquid are measured over time. In a preferred spacer fabric in accordance with the invention the dimensions of the spread of water containing dye are at least 5.5cm x 2.5cm and the spread of liquid reaches near equilibrium in about 15 minutes.

The breathability of the upper surface is preferably such that, when placed face down upon the fabric, a baby can continue to breathe relatively normally.

A suitable air permeability test providing a measure of the breathability of a fabric, i.e. the ease with which air passes through the fabric structure, is BS 4578:1970 Measurement of Restriction of Airflow. Preferably the spacer fabric has a value of less than 5, more preferably less than 2, when tested in accordance with BS 4578:1970.

The fabric preferably has good heat dissipation, such that it can dissipate heat rapidly away from a hot body. Preferably the fabric is such that the temperature of the fabric when placed under a hot plate with an initial temperature of 34°C does not exceed 25°C and more preferably 22°C after 10 minutes, and preferably does not exceed 48°C and more preferably 47°C after one hour.

Without wishing to be limited to any particular theory, it is believed that the preferred embodiments of the present invention achieve breathability and heat dissipation through the use of a combination of a permeable mesh upper surface and a spacer layer which is largely an open structure permitting relatively unimpeded circulation of air and which is relatively crush resistant, such that a baby's weight, when distributed across the spacer material, does not completely crush the spacer layer in use, allowing continued air circulation.

The linking threads of the central spacer layer preferably comprise a monofilament yarn which traverses back and forth between the upper and lower surfaces. Whilst the linking threads can be perpendicularly arranged, they are preferably arranged such that each pair, or group, of threads is in the form of a V-shape, when the fabric is viewed in cross-section, with the angle of the V preferably being from 5° to 55°, for example, about 30° to about 35°. The V-shaped pairs or groups of threads can form a zig-zag pattern.

By arranging for pairs or groups of threads linking the upper and lower surfaces to lie at opposed angles to the perpendicular distance between the upper and lower surfaces, it is possible to improve the resistance of the spacer fabric to "flopping over" when subjected to a compressive force. This " flopping over" is highly undesirable since it can result in the complete flattening of the spacer fabric and the loss of the spacer layer with its properties of breathability and heat dissipation. As the linking threads are angled in alternate directions the spacer fabric can achieve a comfortable, resilient feel whilst still retaining breathability, heat dissipation and a resistance to crushing.

The linking threads need to have a sufficient stiffness to resist complete crushing of the fabric by

the distributed weight of the baby, and yet have sufficient resilience to impart a springiness or "give" to the fabric for comfort. Preferred yarns for use as linking threads have a dTex of from 33 to 108, and are made, for example, from a polyamide such as Nylon, or a polypropylene.

Preferably the spacer fabric is such that the spacer layer requires a work of compression, as measured by BS4098:1975 of at least 60J/m^2, preferably at least 70J/m^2, and a thickness recovery of at least 50%, preferably at least 70%.

The lower surface of the spacer fabric is preferably a multifilament or spun filament warp knitted fabric. Preferably the lower surface is sufficiently tightly knitted to provide a suitable substrate for good adhesion to a non-permeable backing layer.

Liquid impermeability can be imparted to the lower surface of the spacer material by a number of methods, for example, by direct coating of the lower surface of the fabric with a liquid-impermeable polymeric material, by impregnation of a liquid-impermeable polymeric material, or by transfer coating, or laminating, a film of liquid-impermeable polymeric material thereto, to provide a tightly adherent, liquid impermeable, backing layer or impregnated layer. Preferably the liquid-

impermeable layer is provided by laminating a flexible backing layer of a suitable polymeric material, for example, a polyurethane film, to the lower surface of the fabric by means of an adhesive. The layer of polymeric material is preferably from 10 to 30 microns in thickness, and good results and with good spacer material flexibility have been achieved using a 25 micron thick polyurethane layer. Other polymeric film materials, such as, for example, polyethylene and polyvinylchloride may also be used in appropriate circumstances.

Where an adhesive is used for laminating, this may be solvent or heat activated, or cold-cured, but the amount of heat and pressure used in the lamination process must neither be sufficient to compress the resultant spacer material unduly, nor to cause permanent damage thereto. Preferably the adhesive, when set, forms a flexible film in order to permit crumpling and flexing of the material without cracking of the film.

Preferably the backing layer achieves a pass as waterproof when tested in accordance with BS EB 20811:1992.

The backing layer is preferably such that it can be repeatedly machine washed and dried in a tumble dryer without shrinkage or permanent damage thereto.

The foam plastics core or body of the mattress preferably comprises an open cell polymeric foam material, for example, a foam polyurethane, and very good results have been obtained using Vitafoam, a polyurethane foam comprising melamine as a fire retardant additive. Preferably the foam plastics core or body is permeable to air, although with certain spacer materials of high breathability this may not be essential. Perforation of the foam plastics core is not usually required.

Where the spacer material is used as a cover material or mattress protector, it is preferably removable from the mattress core or body for washing purposes, and for example, the cover material or mattress protector may be a loose cover, or provided with a zip at one or more edge regions to permit such removal.

In order to reduce the manufacturing cost of the cot mattress, it is possible to provide the spacer material as the top surface layer only of the mattress, the sides and lower surfaces being made of cheaper standard mattress cover fabric material.

The yarns used for knitting the upper and lower surfaces of the spacer fabric are preferably non-allergenic, and preferably contain no animal fibres. Synthetic yarns and threads, such as, for example, polyamides or polyesters are preferred, and, especially

for the upper surface, they are preferably treated to provide a soft handle. Good results have been obtained with spun or textured Nylon, and the use of brush-effect Nylon is also possible.

Natural yarns such as cotton may also be used for all, or a percentage, of the upper surface yarn, in order to give a natural feel to the upper surface, provided however that the composite cot mattress can still achieve a pass under BS Standard 7177 for resistance to ignition of mattresses, divans and bed bases and BS Standard 1877 fire retardancy test for mattresses and bumpers for childrens cots, perambulators and similar domestic articles.

Spacer fabrics can be knitted, for example, on Raschelmachines with two needle bars. Depending upon the nature of the spacer fabric and its physical requirements, a minimum of four guide bars, and normally 4 to 6 guide bars, are used. In addition to the requirements set out hitherto, the thickness of the yarn used for the spacer threads also depends on the distance between the upper and lower surfaces, the desired softness of the upper surface, and whether the central layer is knitted with one guide bar or with two guide bars knitting in opposition to each other. The manufacturing methods for spacer fabrics are discussed in the aforementioned Karl Mayer brochure. In the spacer

materials of the present invention, the distance between the upper and lower surfaces, that is, the width of the spacer layer, is preferably from 3 to 6mm, more preferably about 5mm.

Preferred embodiments of a spacer material and a cot mattress and mattress cover according to the invention are described in the following Example:

EXAMPLE

A spacer fabric for a material in accordance with the invention is knitted on an RD6N machine using two needle bars and five guide bars. The sequence of operation is as follows:

GUIDE BAR 1 2-0-2-2/2-4-2-2/2-0-2-2/2-4-6-6/6-8-6-6/
6-4-6-6/6-8-6-6/6-4-2-2//

GUIDE BAR 2 6-8-6-6/6-4-6-6/6-8-6-6/6-4-2-2/2-0-2-2/
2-4-2-2/2-0-2-2/2-4-6-6//

GUIDE BAR 3 2-0/2-4/4-6/4-2//

GUIDE BAR 4 2-4/2-0/2-4/4-6//

GUIDE BAR 5 2-2-2-0/0-0-2-4//

Guide bars 1 and 2 form the top mesh surface. The guide bar movement to form the mesh may be varied to make an oval, hexagonal, diamond, square, round, rectangular etc type mesh as desired.

Guide bars 3 and 4 could have different movements for the linking threads, which could in an alternative manufacturing method use only one instead of two guide bars.

Guide bar 5 could again have different movements for the production of different fabric backing types, and/or one or two guide bars could be used.

The construction notation is given in steps of 2 ie. 0-2-4-6-8, where each number represents a movement (or non-movement of the guide bar over one needle space).

Eg. 0-2 is a movement over one needle.
0-4 is a movement over two needles.

The numbers between the / marks represent the movement with respect to a needle bar or bars.

Eg. 2-0/2-4// will mean the guide bar knitting over both needle bars (to use the linking threads).

2-0-2-2/ will mean the guide bar knitting only on one needle bed, as there is no movement (2-2) on the second needle bar.

In a preferred embodiment, by way of example only, the yarn dTex (thickness) is as follows:

Bars 1 and 2 - 2/78 dTex nylon
Bars 3 and 4 - 56 dTex nylon
Bar 5 - 110 dTex nylon

The resultant spacer fabric has a thickness of 5mm, and upper surface mesh hole average diameter of 2mm.

A 25 micron thick liquid-impermeable polyurethane layer is laminated to the lower surface of the spacer fabric produced as described above using a solvent-based adhesive. The resultant spacer material can be slit to 60cm wide and made up into a zip-off cover for a cot mattress. The foam core of the cot mattress is a 10cm thick polyurethane foam material of grade 35M.

All the yarns used in the manufacture of the spacer fabric, and the polyurethane foam of the mattress core, are chosen to be substantially free of arsenic and antimony, and to contain less than 12 parts per million, preferably to be substantially free, of phosphorus.

A spacer fabric spacer material and mattress produced as described above are subjected to the following tests, with results and conclusions as set out below:

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Liquid dissipation test to demonstrate the ability of the fabric to take liquid away from the surface and dissipate it through the fabric structure

The test consists of three parts as follows:

1. Liquid Flow Test

Liquid flow from the surface of the fabric into the structure of the fabric. Liquids with viscosities of from 27.3 to 31.5 dynes/cm are tested. (Based on Oil repellency Rating AATCC method).

The closer the grade is to zero, the more liquids are taken into the fabric.

Grade = less than 1 indicates that liquids of all tested viscosities soaked into the fabric structure and proves liquid would not sit on the fabric surface.

2. Wicking test (Based on BS 3424 Part 18)

Test specimens are suspended over a tray of water containing dye, which leaves a visible stain to indicate the height to which the liquid rises.

The fabric is tested, and compared to a control sample of a woven cotton mattress fabric, in both directions of the fabric.

Result - The spacer fabric wicks liquid to a height of 209mm in the warp and 150mm in the weft following 40 mins exposure. The woven fabric wicks liquid to a height of less than 5mm in both directions following 40 mins exposure.

It can be concluded that the spacer fabric is a superior fabric in terms of wicking liquid through the fabric structure, i.e. the liquid will spread into a relatively thin film within the fabric. Washing removes the liquid.

3. Water Dispersion Test

A solution containing dye is used to measure the spread of liquid into and through the spacer fabric.

A measured amount (0.5ml) is applied to the fabric surface. The dimensions of the area stained due to the spread of liquid are measured over time.

The fabric is compared with control samples of a woven cotton mattress fabric and p.v.c.

It is found that the spread of liquid in the spacer fabric reaches near equilibrium, i.e. maximum spread, after 15 minutes. The dimensions of the area covered are on average, 11cm x 5cm.

Both the cotton woven fabric and p.v.c. are found to have zero spread, and water therefore sits on the surface of the fabrics.

Therefore, the spacer fabric is superior in taking liquid away from the surface of the fabric and dissipating it through the fabric structure.

Air permeability test to assess the breathability of the fabric, i.e. the ease with which air passes through the fabric structure

Test Method : BS 4578 : 1970 (1991)

	Measure of restriction of airflow
Spacer material mattress cover (tested fabric side)	1.7mm H_2O
100% p.v.c. mattress cover	> 40.0mm H_2O
Cotton woven mattress cover	5.1mm H_2O

The closer the result is to zero the better the airflow through the mattress cover.

It can be seen that the spacer material mattress cover has a significantly higher permeability and thus, improved breathability.

The test was repeated using a spacer material mattress cover according to the invention, with various textile sheets overlays, simulating a typical use. The results are as follows:

+ flannelette sheet	5.1mm H_2O
+ knitted interlock sheet	3.4mm H_2O
+ knitted terry sheet	3.1mm H_2O

The results show that the spacer material mattress cover is at least as good as a cotton woven mattress cover even when in combination with a flannelette sheet overlay.

After washing in accordance with BS49236A at 40°C and line drying, the air flow restriction of the spacer material mattress cover of the invention was still only 2.1mm H^2O.

Waterproofness Test

A waterproofness test of the liquid impermeable layer of the spacer material (BS EN 20811:1992) is carried out and the layer is found to pass as waterproof.

Fire Retardancy Test

The Mattress is tested for fire retardancy to the standard laid down in the Furniture and Furnishing (Fire)(Safety) Regulations 1988. The result is a pass.

Washability Test

Washability tests are carried out. The suitable care instructions are:

(i) wash as synthetic - maximum temperature 40°C
(ii) no bleach
(iii) no iron
(iv) no dry clean
(v) no tumble drying

Thickness Compression and Recovery Test

Samples were tested following the procedure described in BS4098:1975. The samples were tested with

the liquid impermeable lower surface layer uppermost. Average results are as follows:

Original thickness	4.4mm
Compression	3.4mm (i.e thickness reduced to 1.0mm)
Work of compression	73 J/m^2
Thickness recovery	72.7%
Compression recovery	64.7%
Work recovery	34.2%

The results show that the spacer material has a substantial recovery after compression.

Heat dissipation test

A rectangular hot plate with an initial temperature of 33.8°C was placed on a mattress cover according to the invention and the temperature build-up of the mattress cover under the hot plate and up to 12 cms distant from the edge of the hot plate measured using two sets of five thermocouples, the individual thermocouples in each set being disposed at intervals of 4 cms apart. A 100% PVC mattress cover was used as a control. The results are shown in Tables 1 and 2 and illustrated graphically in Figure 3 of the drawings. Thermocouples 1 and 6 were disposed under the hot plate in the central region thereof and 10 cms apart. Thermocouples 2 and 7 were disposed at the edge of the hot plate. Thermocouples 3

to 5 (and 8 to 10 similarly) were disposed in a line, respectively 4cms, 8cms and 12 cms from the edge of the hot plate.

Tables 1 and 2 give the results for all the thermocouples 1 to 10. Figure 3 shows graphically the temperature rise with time for thermocouples 1, 3, and 5. The results show that, using the mattress cover of the invention, the temperature rises more slowly, and even after 75 minutes, the temperature under the hot plate using the mattress cover of the invention is significantly lower than that of the PVC control.

An embodiment of a spacer material according to the invention is illustrated in the accompanying Drawings in which:

Figure 1 shows the upper surface of a portion of the spacer material in plan view; and

Figure 2 shows a sectional side elevation of the spacer material of Figure 1.

Referring to the Drawings, the spacer material illustrated generally at 1 comprises a spacer fabric 2 having an upper surface 3 comprising a mesh with holes 4. In Figure 2, there is shown the spacer layer 5, having spacer threads 6, disposed in generally V-shaped groups

7, with an acute angle α, as illustrated, between threads of opposed inclination. The lower surface 8 of the spacer fabric 2 has laminated thereto a flexible liquid impermeable polymeric film 9.

Preferred embodiments of the mattress cover material of the invention have a number of advantages over spacer fabrics hitherto proposed.

1. The spacer materials can achieve breathability by using a mesh as the upper surface and maintaining a spacer layer between the upper and lower surfaces to create a route for the relative free movement of air.

2. The linking threads connecting the upper and lower surfaces of the spacer fabric can be of a stiffness and orientation sufficient to maintain the spacer layer against compression in use, and to maintain a good air movement ability, which allows convection air currents within the spacer layer to transfer heat away from the baby's body, thereby preventing heat build-up and heat stress to the baby.

3. The mesh upper surface can allow drainage of body fluids into the spacer layer and the open structure of the spacer layer can allow the fluids to be dissipated, thus reducing discomfort to the baby.

4. The liquid impermeable lower surface of the spacer material can protect the foam plastics mattress core from body fluids thus maintaining hygienic conditions.

5. The spacer material can be washable, thus preventing or reducing bacterial growth, and enhancing the hygiene of the cot environment.

6. The spacer material can retain sufficient compressibility and "give" to allow comfort and an improved rest environment.

7. The spacer material can be used with a foamed core mattress which does not need to be perforated, thereby simplifying manufacturing procedures.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination,

except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). This invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

TABLE 2

100% PVC MATTRESS COVER

Temperature Probe	1	2	3	4	5	6	7	8	9	10
Starting temp.	20.1	20.3	20.3	20.3	20	20.2	20.1	20.2	20.2	20
Temp after hot plate applied										
1	33.7	22.7	20.2	19.8	19.5	33.6	22.3	19.9	19.8	19.5
5	36	23.1	20.1	19.7	19.3	35.9	22.5	19.8	19.4	19.1
10	38.7	23.6	20.3	19.7	19.4	38.5	22.9	19.9	19.4	19.2
15	40.7	24.2	20.4	19.7	19.4	40.4	23.4	19.8	19.5	19.2
20	42.2	24.6	20.6	19.9	19.6	42	23.7	20.1	19.6	19.6
25	43.7	24.8	20.4	19.7	19.4	43.4	23.8	20	19.5	19.1
30	44.7	25	20.5	19.8	19.4	44.4	24.1	20.1	19.6	19.2
35	45.9	25.3	20.6	19.9	19.4	45.5	24.1	20.1	19.6	19.2
40	46.5	25.6	20.7	19.9	19.5	46.2	24.2	20.2	19.7	19.2
45	47.2	25.6	20.6	19.9	19.4	46.9	24.2	20.2	19.7	19.2
50	47.8	25.8	20.7	19.9	19.5	47.5	24.3	20.2	19.7	19.1
55	48.2	26.1	20.6	19.8	19.4	47.9	22	20.1	19.7	19.1
60	48.6	26.1	20.6	19.9	19.5	48.3	22.2	20.2	19.7	19.2
75	49.7	26.3	20.8	20	19.5	49.4	22.1	20.3	19.8	19.1

CLAIMS

1. A spacer material, which comprises a fabric, providing a liquid permeable and breathable upper surface and a heat and liquid dissipating spacer layer, and a liquid impermeable lower surface layer.

2. A material according to Claim 1, in which the fabric is a spacer fabric.

3. A material according to Claim 1 or 2, in which the upper surface of the fabric comprises a warp knitted mesh.

4. A material according to Claim 3, in which the mesh has an average hole diameter of from 1 to 3mm.

5. A material according to any of the preceding claims, having an upper surface such that liquids of viscosity of at least 20 dynes/cm can pass through the upper surface and into the spacer layer.

6. A material according to any of the preceding claims, in which the upper surface has a grade of less than 1 when tested in accordance with the Oil Repellency Rating AATCC method.

7. A material according to any of the preceding claims, in which, when tested in accordance with BS 3424 Part 18, the fabric is such that the wicked liquid rises to a height of at least 125mm, in both the warp and weft directions, in a time period of 40 minutes.

8. a material according to any of the preceding claims, in which, when 0.5ml of water containing a dye is applied to the upper surface, the dimensions of the spread of water are at a least 5.5cm x 2.5cm, and the spread of water reaches near equilibrium in about 15 minutes or less.

9. A material according to any of the preceding claims, in which the spacer fabric has a value of less than 2.5 when tested in accordance with BS 4578:1970 Measurement of Restriction of Airflow.

10. A material according to any of the preceding claims, in which the linking threads of the spacer layer comprise a monofilament yarn which traverses back and forth between the upper and lower surfaces.

11. A material according to Claim 10, in which the linking threads are arranged in pairs or groups in the form of a V-shape, when the fabric is viewed in cross-section.

12. A material according to Claim 11, in which the angle of the V is from about 5° to about 55°.

13. A material according to any of the preceding claims, in which the linking threads for the spacer layer comprise a yarn having a dTex of from 33 to 108.

14. A material according to any of the preceding claims, in which the linking threads for the spacer layer comprise a polyamide yarn.

15. A material according to any of the preceding claims, in which the lower surface of the spacer fabric comprises a multifilament or spun filament warp knitted fabric.

16. A material according to any of the preceding claims, in which the lower surface of the fabric is sufficiently tightly knitted, in order to provide a suitable substrate for good adhesion to a non-permeable backing layer.

17. A material according to any of the preceding claims, in which the lower surface layer is rendered liquid-impermeable by direct coating of a liquid-impermeable polymeric material, by impregnation of a liquid-impermeable polymeric material, or by transfer coating, or laminating, a film of liquid-

impermeable polymeric material to the lower surface of the fabric.

18. A material according to any of the preceding claims, in which the lower surface of the fabric is rendered liquid-impermeable by laminating a layer of polymeric material thereto by means of an adhesive.

19. A material according to Claim 12 or 13, in which the lower surface of the fabric is laminated to a flexible layer of polymeric material of from 10 to 30 microns in thickness.

20. A material according to any of Claims 13 to 15, in which the lower surface of the fabric is laminated to a layer of a polyurethane film.

21. A material according to any of the preceding claims, in which the backing layer achieves a pass as waterproof when tested in accordance with BS EN 20811:1992.

22. A material according to any of the preceding claims, in which the yarn used for knitting the upper surface comprises a polyamide or a polyester.

23. A material according to Claim 22, in which the polyamide is spun or textured Nylon.

24. A material according to any of the preceding claims, in which the distance between the upper and the lower surfaces of the fabric, that is, the width of the spacer layer, is from 3 to 6mm.

25. A material according to any of the preceding claims, in which the fabric is such that the temperature of the fabric when subjected to a heat dissipation test as hereinbefore defined does not exceed 22°C after 10 minutes, and does not exceed 47°C after one hour.

26. A material according to any of the preceding claims substantially as described in the Example or as illustrated in the accompanying Drawings.

27. A spacer material substantially as hereinbefore described.

28. A mattress cover which comprises a spacer material comprising a fabric, providing a liquid permeable and breathable upper surface and a heat and liquid dissipating spacer layer, and a liquid impermeable lower surface layer.

29. A mattress cover according to Claim 28 in which there is used a spacer material according to any of Claims 2 to 27.

30. A mattress cover substantially as hereinbefore described.

31. A mattress comprising a foam plastics core and a cover, the cover comprising a spacer material comprising a fabric, the fabric providing in use a liquid permeable and breathable upper surface and a heat and liquid dissipating spacer layer, and a liquid-impermeable lower surface layer.

32. A mattress according to Claim 31, the mattress achieving a pass under BS Standard 7177 for resistance to ignition of mattresses, divans and bed bases and BS Standard 1877 fire retardancy test for mattresses and bumpers for childrens cots, perambulators and similar domestic articles, and being devoid of fire retardant additives comprising antimony, phosphorus or arsenic.

33. A mattress according to Claim 31 or 32, in which the foam plastics core of the mattress comprises an open cell polymeric foam material.

34. A mattress according to any of Claims 31 to 33, in which the foam plastics core comprises a foam polyurethane.

35. A mattress according to any of Claims 31 to 34, in which the cover is removable from the mattress core for washing or cleaning purposes.

36. A mattress according to any of Claims 31 to 34, in which there is used as a cover a spacer material according to any of Claims 1 to 27.

37. A mattress according to any of Claims 31 to 36 substantially as described in the Example.

38. A mattress comprising a core at least partly covered by a spacer material according to any of Claims 1 to 27.

39. A cot mattress substantially as hereinbefore described.

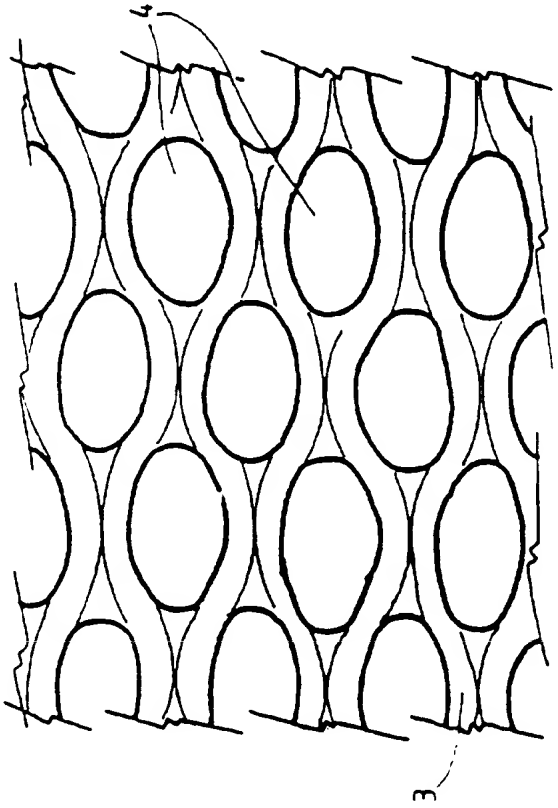

Fig.1.

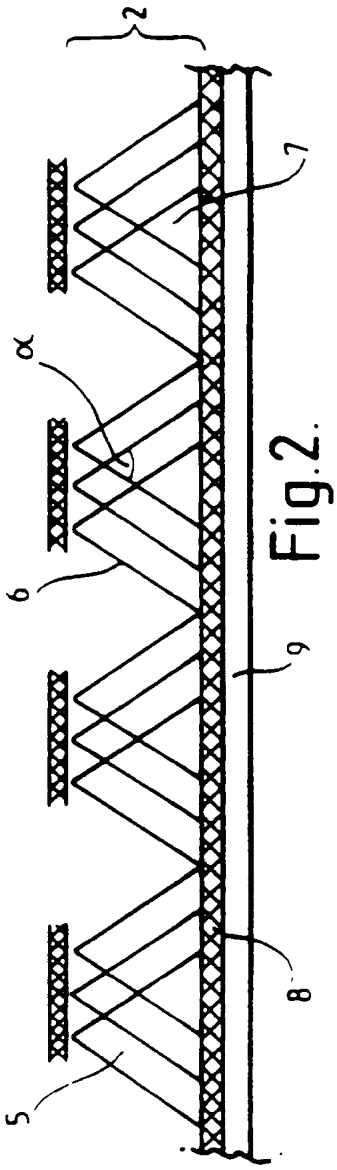

Fig.2.

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Temperature Build-up

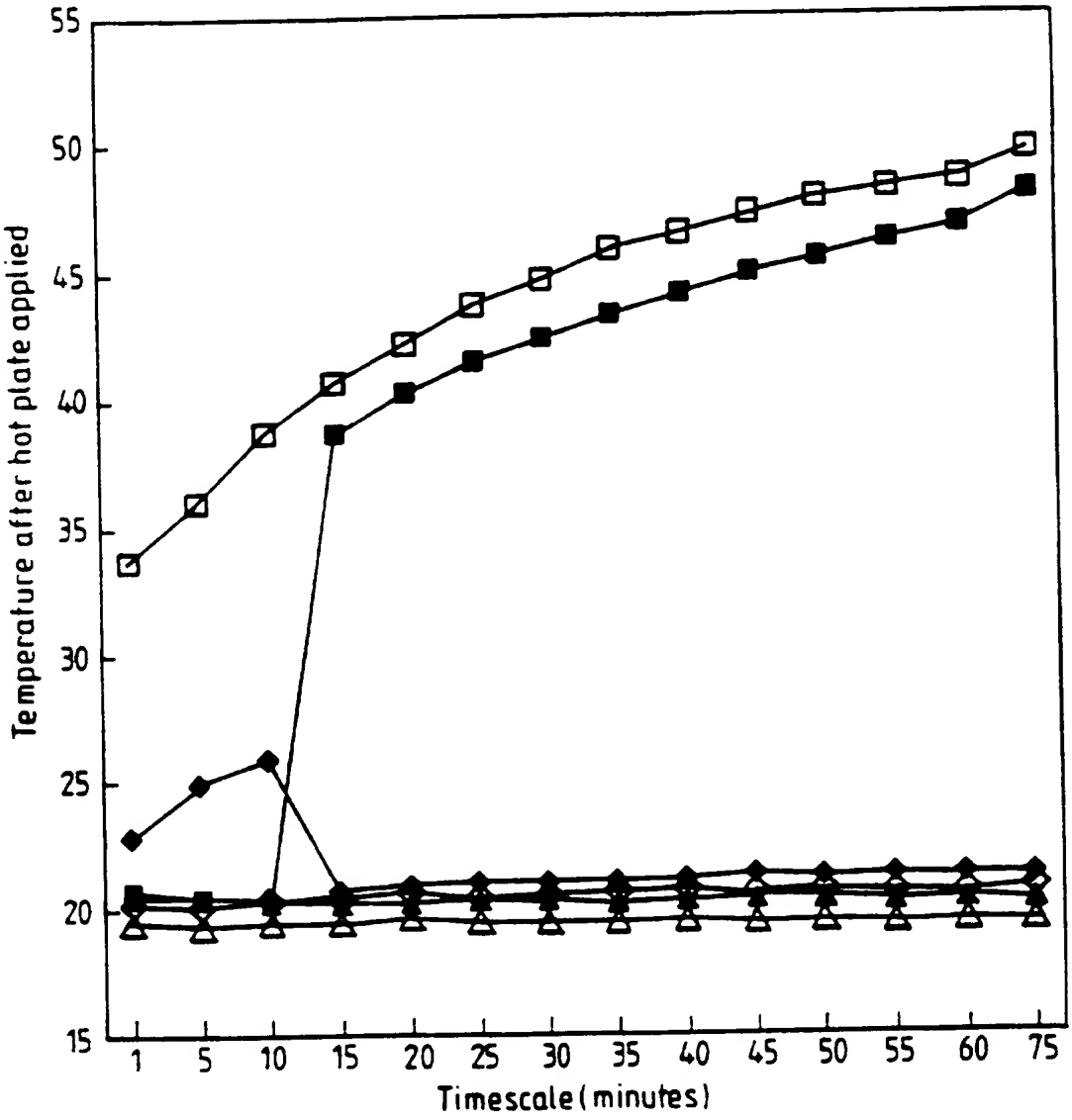

Fig.3.

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/GB 96/00834

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 D04B21/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 D04B D03D A47G A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP,A,0 369 392 (AKZO N.V.) 23 May 1990 see claims 1-6; figure 1	1,2,18, 28,29, 31,35,36
A	GB,A,2 189 993 (DILLOWAY) 11 November 1987	
A	DE,U,93 09 374 (HOECHST AG) 19 August 1993 cited in the application	
A	DE,A,42 39 068 (RICKERL) 26 May 1994	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

'A' document defining the general state of the art which is not considered to be of particular relevance

'E' earlier document but published on or after the international filing date

'L' document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

'O' document referring to an oral disclosure, use, exhibition or other means

'P' document published prior to the international filing date but later than the priority date claimed

'T' later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

'X' document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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'&' document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 June 1996	12.07.96

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+ 31-70) 340-3016	Van Gelder, P

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INTERNATIONAL SEARCH REPORT

...ormation on patent family members

Inter nal Application No
PCT/GB 96/00834

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
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		CA-A-	2003243	18-05-90
		WO-A-	9005505	31-05-90
		EP-A-	0407505	16-01-91
		JP-T-	3503250	25-07-91
GB-A-2189993	11-11-87	NONE		
DE-U-9309374	19-08-93	EP-A-	0616065	21-09-94
DE-A-4239068	26-05-94	NONE		